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NAVIGATION LOCKS.

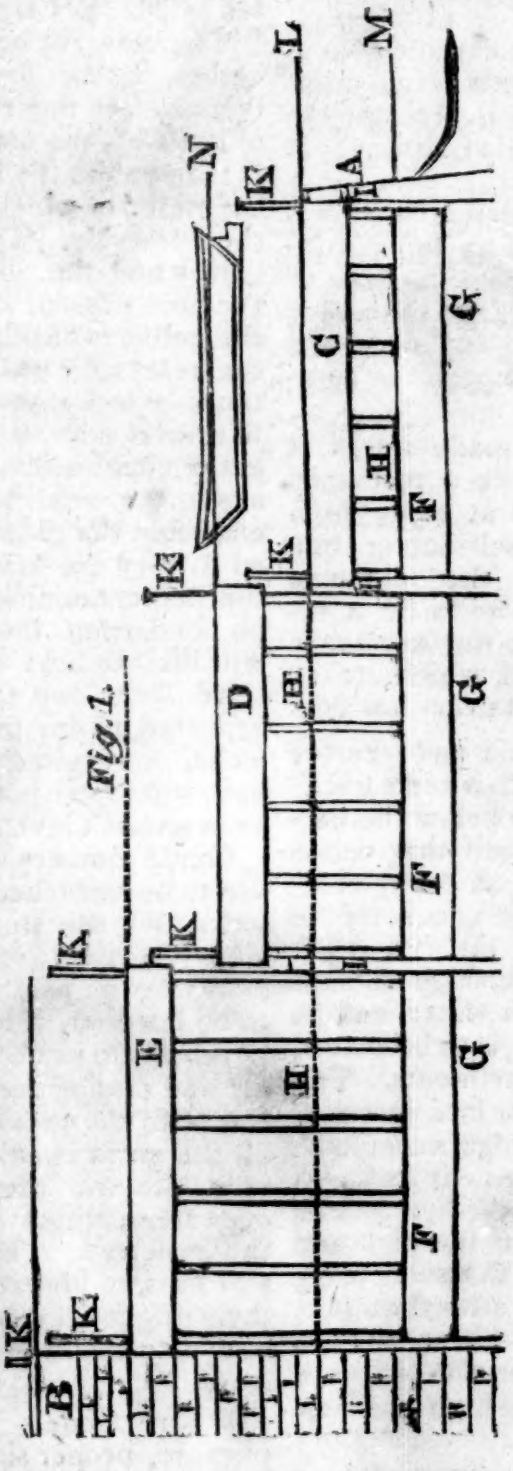


Fig. 1.

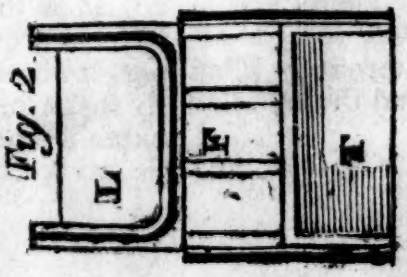


Fig. 2.

NAVIGATION LOCKS, PROPOSED BY GEORGE STRICKLAND, OF PHILADELPHIA.

In many situations there is great difficulty in procuring supplies of water on summit levels, for feeding locked canals, so as to insure a constant passage for boats; while at different, and oftentimes inconsiderable distances below, a much greater quantity may be obtained than is necessary to maintain the navigation throughout all the inferior levels.

The object of the plan before us is to apply this water of an inferior level, whether it be from feeders or tides, to the purpose or use of passing boats, vessels, &c, to and from said level, from and to a superior or summit level.

Where the tide is made use of, it is necessary to provide a reservoir, which is to be filled at every high water, by means of self-acting tide gates, according to the common practice. There is also to be a receiver furnished with the necessary self-acting drain gates, which are to let the water from it at every low tide.

Between the reservoir and receiver a long rectangular cell is to be excavated for some depth below the bottom of the receiver, and this cell is to be subdivided into as many compartments as may be neaessary to procure the required lift. A tight vessel or tank, large enough to support a lock filled with water, and its sustaining frame work, is to be placed in each of these compartments. The frame works of the first lock just sustain it even with the high water line; the frame works of the next lock elevate it as much above the first lock as the distance is between the high and low water lines; and the succeeding locks are elevated, one after the other, to the same height. These lifts are not to be greater than the distance between the ordinary high and low tides.

Each of the compartments should be furnished with gates, so as to allow of their being alternately filled from the reservoir, and drained into the receiver.

One end of each lock is to be furnished with a hose packing, which is supplied with water or oil from a small reservoir, somewhat elevated above the surface of the water in the locks, so as to maintain tight joinings between them, from the hydrostatic pressure, according to the plan devised by Mr. E. Clark.

The vessel or boat to be passed up, enters, in the first place, from the tideway into the reservoir, by means of locks of the common construction. It then enters the first moveable lock, the water of which is on a level with the reservoir. The gates of the receiver and the lock, through which the boat passed, are to be closed, and the cell is to be filled with water from the reservoir, which will cause the tank, or lock supportary vessel to rise to a level with the second lock. The gates communicating with this lock are in the next place to be opened, and after the passage boat has entered it, they are to be again closed, and the cell containing its tank is also to be filled from the reservoir, which will lift the boat to a level with the third lock; and this operation being repeated to any proposed number of locks, or required lifts, the passage boat will arrive in the canal at a higher or summit level.

Guide timbers and friction-rollers are to be attached to the tanks and locks, for the purpose of securing a steady vertical ascent and descent.

When a passage boat requires to be lowered, it is only necessary to perform the same operation of opening and closing the gates communicating with the canal locks, and to close all the gates opening from the reservoir into the respective cells, and open those which drain the cells into the receiver. The different locks will thus be lowered in succession to their original levels, and the passage boat may continue its voyage at pleasure.

Where feeders are used for this purpose, proper sites must be selected, so as to admit of the cells being filled and drained in the same manner, from and to the requisite levels. By these means the navigation may be extended on levels, where a very little water can be obtained over and

above what may be required to supply the evaporation and absorption, the only waste being that which escapes from between the gates, which, if Mr. Clark's plan for closing them be adopted, will be very inconsiderable, and may be furnished from the lower levels by their proper adjustment.

Explanation of the Drawing.

Fig. 1.

A represents the lower level.

B, the upper level.

C, D, and E, three locks, designed to operate at intermediate levels.

F, F, F, three tanks, for floating CD and E.

G, G, G, three cells, containing the tanks.

H, H, H, frame-work resting on the tanks, and supporting the locks.

I, I, I, partitions between the cells, and the first cell and tide water.

K, K, &c. gates between the locks, and at their termination.

L, high water mark.

M, low water mark.

N, shows a boat, and the water line of the first lift.

Fig. 2.

L, section of the lock on an enlarged scale.

F, frame work, represented in fig. 1, by H, H, H.

T, section of the tank.

ON LAMP-BLACK AND OTHER SUBSTANCES TAKING FIRE OF THEMSELVES.

With a view to the prevention of fires, it is necessary to be aware that there are substances which, when warmed to a certain degree, or being merely mixed with oils, take fire.

In 1781, a frigate, in which no fire had been made for five days before, suddenly took fire in the port of Cronstadt, just as she was preparing to set sail; the fire beginning in a parcel of lamp black, mixed with boiled hempseed oil. Upon this a Mr. Georgi was ordered to investigate the subject, when he discovered the following facts:—

3lbs. Russian lamp black was mixed with 5lbs. of boiled hempseed oil, and left exposed to the air for five hours; it was then wrapped in a coarse cloth, and laid in a chest. In sixteen hours it yielded a very offensive smell, like that of boiling oil, it grew warm, and emitted a quantity of watery steam; in two hours more a stinking smoke appeared, and some places took fire, while others were scarcely warm. It was then taken out, and laid on a stone floor, where a slight flame arose from it, and whenever any openings were made in the mass, a vapour was emitted, which soon after took fire. On breaking up the whole mass, a brisk flame arose, which soon ceased, but the matter continued to glimmer for six hours, with much smoke at first, but not afterwards; in eight hours the whole was reduced to 5oz. and a half of gray ashes.

Another parcel of the same ingredients did not take fire till forty-one hours after the mixture of the oil and lamp black. In general it was found that the mixture took fire sooner in clear weather than in rainy.

3lbs. Russian lamp black, mixed with 3lbs. of unboiled hempseed oil, took fire in nine hours.

12oz. of fine German lamp black, with 24oz. of boiled hempseed oil, did not grow even warm until seventy hours elapsed, although it then became hot, and emitted a steam for 36 hours; it did not take fire, nor were the vapours inflammable.

From a number of similar experiments, he found that the mass took fire much sooner when the coarse, greasy, heavy lamp black made in Russia is impregnated with oil, than when the light and fine lamp black of Germany, or when wood soot is used: and that it is only the drying oils, whether boiled or unboiled, that take fire. The mixture took fire although the proportion of the lamp black and oil were very different; in some experiments the oil was only one-tenth of the lamp black, in others it was twice the weight of the colour.

Lamp black was not the only substance that took fire of itself.

30lbs. of hemp, impregnated with 3lbs. of tallow and 3lbs. of hempseed oil, began to smoke in about an hour, and in another hour took fire, and burnt for five hours with a visible

flame; a very dry wind blew the whole time, which might have some effect.

20lbs. of wool, impregnated with 2lbs of Hempseed oil and one of tallow, were heated in a small oven, then cooled, and sewed up in a mat: at the end of three days no other alteration had taken place than that the oil and tallow was so thoroughly absorbed by the wool, that it was scarcely perceptible. Another pound of hempseed oil was then added, the mass slightly heated, tied up in a coarse linen cloth, and laid on some wood; in a few hours the packet grew warm, in some places emitted a slight smoke, and in two hours afterwards it took fire, and after burning forty-four hours, left 2lbs. 6oz. of very fine ashes.

The same taking fire of itself, took place in many other experiments; such as steeping cow hair and wool in oil, and then heating them to a certain point; as also in roasted pearl-barley and husked rice; in which the larger the grains are, the less they are disposed to take fire.

Coffee roasted brown, and bound up in linen, did not take fire; but 2 lbs. of ground coffee took fire in three quarters of an hour, and continued burning till only half an oz. of ashes remained.

Mahogany saw dust roasted brown, and wrapped up while warm, took fire in a quarter of an hour.

2lbs of fir saw dust, being roasted, became on account of the different size of its particles, partly black and partly white; on being wrapped up it soon lost its heat, but in an hour afterwards it soon became hot, smoked, and took fire.

Some barley coffee, roasted till it was brown, being put into a shallow pot, and but slightly covered with its lid, became warm, and smoked at the end of fourteen hours; no flame could be seen even in the dark, but the mass appeared red—paper, and even bits of wood put on the mass soon took fire, and a knife stuck in it became red hot; in twenty-four hour's time the fire was extinguished.

These experiments are of great importpnce. In the drying of malt, and in roasting other substances of a similar nature the malt, or other materials may take fire of themselves in a corner of the kiln, a long time after the operation is finished, and that even in the open air, and without giving any sign of being on fire, except a trifle of smoke or steam burn for a considerable time, and do a great deal of mischief. It also appears that the smaller kinds of grain, as well as flour, saw dust and other minutely divided and inflammable substances, when laid together in considerable quantities, and especially when united with oily matters, are capable of taking fire of themselves under certain circumstances.

Messrs. Hagemann and Geller observed, that even boiled oils, if thoroughly deprived of all their water, will sometimes take fire of themselves; an instance of which occurred a few months since, when a coachmaker's workshop took fire in consequence of the bursting of an oil cistern at the top of the house; although it may admit of some doubt whether the oil did not take fire first.

A number of instances are on record respecting mills being burnt down, or explosions taking place in consequence of the flour heating and emitting an inflammable vapour, which took fire on a person's entering with a light. The destruction of the Albion Mills, at the end of Blackfriars Bridge, has been attributed to this cause.

But the most singular instances of substances taking fire of themselves, are those of men and women who have been found burnt or burning; which instances are too well attested to admit of any doubt.

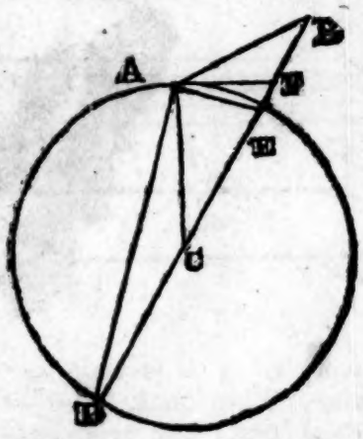
Lond. Mec. Jour.

ON MEASURING THE HEIGHT OF OBJECTS.

SIR,—As some of your readers, no doubt, would wish to be acquainted with the method of determining the quantity of depression of two distant objects on the surface of the earth, and also the principles upon which that depression is founded;

allow me, therefore, to contribute a few lines to your Miscellany for furthering this object.

In measuring the height of any object, the angles are usually determined by the application of spirit levels to the angular instrument, or, simply by the plummet; but when the objects are very distant, it is evident that this method will require some correction; and for this purpose, let A and B represent two remote objects; C the centre of the earth, to which all bodies gravitate. Join AB, BC, and produce it to D; draw AF a tangent to the circle, and join AE, AC, AD. Now, the converging lines AC, BC, will indicate the direction of the plummet at A and B, and the tangent AF will mark the line of the horizon from A.—Again the angle, as measured at A, by the instrument, is only the angle F A B which is less than the true angle EAB by the angle EAF. But by a well known property of the circle (Euclid, Lib. 3, Prob. 32) the angle EAF is equal to the angle ADB, and this again is equal to half the angle at the centre, viz. ACB. Hence the true angle EAB=FAB+ half the measure of the intercepted arc AE; but as this measure depends upon the curvature of the earth, which is neither uniform nor regular, the measure for each particular place must be deduced from the corresponding degree of latitude



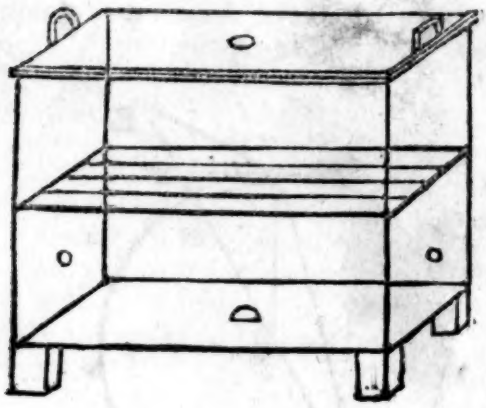
In ordinary calculations, however, such nicety is unnecessary; we will be sufficiently near the truth if we assume the earth as a perfect sphere, whose circumference is 24856 miles; the arc of a minute upon the meridian will, therefore, be 6076 feet; the correction to be added to the observed vertical angle will, therefore, amount to one second for every sixty-nine yds. contained in the intervening distances between the objects.

From what we have stated, the quantity of depression FE, is easily found; for, from Euclid, Lib. 3, Prop. 36, AF2=DF, FE, or very nearly DE, EF, and from this equation we conclude that the depression of any object is always proportional to the square of its distance AF; consequently, in the space of one mile, this depression will amount to 52807912th parts of a foot, and generally we may express it in feet by two-thirds of the square of the distance in miles; but this depression, arising from the earth's curvature, is modified in a small degree by another cause, arising from the refraction of the rays of light in passing through the atmosphere; and this trajectory may be considered as very nearly the arc of a circle, having for its radius about six times the radius of our globe, or about 23736 miles. Now, in order to correct this error, we have only to diminish the effect of the earth's curvature one-sixth, or, what is equivalent, deduct from the vertical angles the twelfth part of the intervening terrestrial arc.

I am, sir,
Your obedient servant,
NICOL DIXON.

Lond. Mec. Mag.

STEAM WASHING BOX.



SIR,—I send you a drawing of a family steam washing machine. The figure represents a strong deal box, resting on pedestals, of an oblong shape, and about four feet long. According to the height in the clear shelves are to be fitted, so as to rest on cleats, and be removeable at pleasure. The distance between the shelves should be about six inches, and the shelves are to be formed of bars or laths, so that each shelf may consist of a single perforated frame, similar to a gridiron. The cover, which takes off, is to be steam tight; and when on is to be fastened by a bar that runs through the two projecting staples.—A puppet-valve is to be inserted into the cover, and supported so that it may rise and fall without being thrown out. A cock, or spigot and faucet, is to be inserted in the side, and close to the bottom.

The manner of proceeding is as follows:—

The linen are to be first rubbed separately with hard soap, then placed on the lowest shelf (the fewer pieces the better) and spread at full length; then put a shelf over these on its rest, with soaped linen on it; then another shelf, and so on; observing to act so as to promote the transmission of the steam as much as possible through the linen.

A pipe, having a stop cock in some part of it, being inserted in the top of the wooden vessel of the boiling machine is likewise to be inserted in the side of the steam washing box; then it is only necessary to turn the stop-cock by which the steam enters, and the process of steam washing goes on. After some time, turn the cock of the washing box, to let off the dirty water, do this at intervals, and when water is perfectly clear, the linen is strained enough. The linen is then to be taken out and rinsed, when it is fit for drying

Wood that yields colour and turpentine, and metal on the inside of the box, are to be carefully avoided.

Should the steam from the water box not be strong enough, it may be obtained from a common cooking kettle, the lid of which has a three-inch tube in length soldered in it, to admit the junction of the above mentioned service pipe; which pipe being removeable from both the boiler and the steam box, the latter being laid by in any convenient place until again wanted.

Your obedient servant,

H. S.

ib.

ON PASTE FROM HORSE CHESNUTS.

It is said that a German shoemaker has introduced the use of a paste made from horse chesnuts.

The nuts are peeled, cut in pieces, well washed and dried; then bruised in a mortar, and boiled in the usual manner into paste, with water.

Lond. Mec. Jour.

DESCRIPTION OF THE DANAIDE, A MACHINE ACCELERATED BY FRICTION.

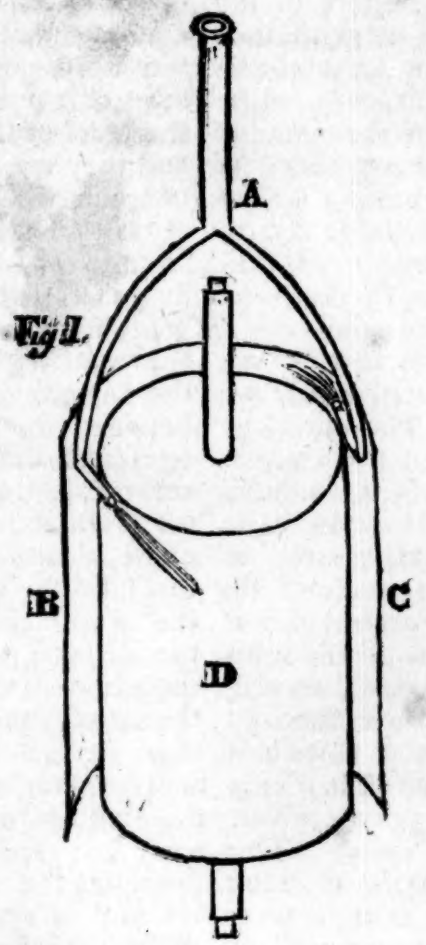


Fig. 1.

Fig. 2.

DESCRIPTION OF THE DANAIDE, A MACHINE ACCELERATED BY FRICTION.

SIR,—Although the effects of friction are an insurmountable obstacle to the engineer, yet, nevertheless, there are some machines wherein friction, instead of retarding, actually accelerates the moving force; and I beg leave to place before you the drawing of a machine, where this assertion is strikingly exemplified. As I have never seen any drawing or model of this machine as it came from

the hands of its inventor, M. Mannoury Dictot yet I have endeavoured to supply this defect to your readers from the description as given of this machine by Msssieurs Perier, Prony, and Carnot, in their Report to the French Institute. These gentlemen also tried to ascertain what might be the amount of the effect produced by the Danaide (for that is the name of the machine) by fixing pulleys in such a manner as to raise a weight from the ground, and, by many repeated trials, they discovered that 7-10ths, and sometimes 75-100ths of the moving power, was the effect produced—an effect, in fact, which is greater than any machine that we are acquainted with. The model by which Dictot exhibited his experiments consists principally in a trough, the bottom of which has a hole in its centre; it is cylindrical, nearly as high as it is broad, and made of tin plate It is fixed to a vertical axis of iron, which passes through the middle of the hole in the bottom, leaving a vacant space all around, through which water escapes as it flows into the trough from above. This axis turns with the trough upon a pivot, and is fixed above to a collar. The object of the inventor was, that the water flowing into the trough from above, with a certain quantity of *vis viva*, should communicate the whole of it to the solid parts of the machine, so as to be employed afterwards in producing some useful effect, always excepting the small quantity of force necessary to enable the water to escape by the orifice below. This object he thus obtains:—Within the trough there is affixed to the axis a drum, likewise of tin plate, concentric with the trough, and close above and below; this drum, which turns round with the trough, occupies nearly the whole of its capacity, the space between the two not exceeding an inch and a half; a similar space exists also between the bottom of the trough and the drum; it is, however, less than the former, and is divided into several compartments, by diaphragms proceeding from the circumference to the central hole in the bottom of the trough. These diaphragms do not exist between the sides of the drum and the trough, and the compartments of the bottom communicate with this annular space. The water, which comes from a reservoir above, by one or two pipes, makes its way into this annular space between the drum and the trough; the bottoms of these pipes correspond with the level of the water in the trough, and they are directed horizontally, as tangents to the mean circumference of the trough and of the drum. The force which the water has acquired by its fall along the pipes, causes the machine to move round its axis; and this motion gradually accelerates, till the velocity of the water in the space between the trough and the drum equals that of the water from the reservoir, so that the shock of the water from above upon that in the machine becomes imperceptible. Now, this circular motion communicates to the water between the trough and the drum a centrifugal force, in consequence of which it presses against the sides of the trough The centrifugal force acts equally upon the water contained in the compartments at the bottom of the trough, but obviously less and less as the water approaches the centre The whole water then is actuated by two forces, which oppose each other, namely, gravity and the centrifugal force.—The first tends to make the water run out at the orifice at the bottom of the trough, the second tends to drive the water from that hole To these two forces are joined a third, namely, friction, which acts an important and singular part, since it promotes the efficacy of the machine; while in other machines it always diminishes that efficacy Here, on the contrary, the effect would be nothing, were it not for the friction, which acts in a tangent to the sides of the trough and drum. By the combination of these three forces, there must result a more or less rapid flow from the orifice at the bottom of the trough, and the less force the water has as it escapes, the more it will have employed in moving the machine, and consequently in producing the useful effect for which it is destined. The moving

power is the weight of the water running in, multiplied by the height of the reservoir from which it flows above the bottom of the trough, and the useful effect is the same product diminished by half the force which the water retains when it issues from the orifice below. The prefixed drawing of this machine will convey some idea of its construction to your readers.

Description of the Drawing.

Fig 1.

A represents the main for conveying the water.

BC, the trough, the bottom and one side being taken away.

D, the drum, with its axis.

E, the bottom of the trough, as divided into compartments, &c.

Fig. 2.

Section of the bottom of the trough, with the diaphragms; the dotted circle represents the drum.

I consider this machine as being worthy the attention of the practical engineer.

Your most obedient servant,

JAMES YULE.

ib.

ON THE CHARACTERISTIC DIFFERENCE OF IRON AND STEEL.

All iron that, when made red hot becomes harder by being hastily quenched in cold water, is called steel. This single characteristic suffices for the distinguishing of steel from the softest iron; which, on being made red hot, and quenched in like manner, does not become sensibly harder, but after this may be bent, as likewise be hammered and filed both hot and cold, almost as easily as before.

As soon as iron, in consequence of being made red hot, and cooled quickly, becomes in a sensible degree more inflexible, brittle, and hard, it already partakes of the nature of steel. It is true, cold-shot iron likewise becomes brittle after being hardened, but does not acquire a greater degree of hardness than it had before, when it was equally brittle.

Steel, on the contrary, should, both cold and hot, be almost as malleable, before it is hardened, as iron, and after being hardened recover this malleability in consequence of fresh ignition; still, however, it is more or less tough in proportion to its hardness. That steel which, in quenching acquires the greatest hardness in the lowest degree of heat, and retains the greatest strength in and after induration, may be fairly considered as the best.

The other characters by which steel is distinguished from iron are as follows:—

1. After being furbished, steel appears of a white, light gray hue, without the blue cast exhibited by iron. It also takes a higher polish.

2. The hardest steel, when not annealed, appears granulated, but dull, and without shining fibres.

3. When steeped in acids, the harder the steel is of a darker gray hue is its surface.

4. Steel is not so much inclined to rust as iron.

5. In general steel has a greater specific gravity.

6. By being hardened and wrought it may be rendered much more elastic than iron.

7. When indurated it becomes more sonorous than iron.

8. When furbished, it appears more close and dense than iron.

9 It is not attracted so strongly by the magnet as soft iron is. It likewise acquires magnetic properties more slowly, but retains them longer; for which reason steel is used in making needles for compasses and artficial magnets.

10. By hammering and friction it acquires a greater magnetic power than iron does.

11. In heat, steel expands more than iron.

12 By induration, or quenching in water, it retains nearly the same bulk as it had acquired in heat, or, at least, contracts very little; while, on the other hand, iron contracts to the same space as it took up before it was ignited.

13. Steel is ignited sooner, and fuses

with a less degree of heat than malleable iron, which can scarcely be made to fuse without the addition of powdered charcoal, by which it is converted into steel, and afterwards into crude iron.

14. By a particular management it may be fused and cast, and yet continue to be malleable, which is scarcely the case with soft iron.

15. Polished steel is sooner tinged by heat, and that with higher colours than iron.

16. In a calcinating heat it suffers less loss by burning, than soft iron does in the same heat and the same time. In calcination, a light blue flame hovers over the steel, either with or without a sulpherous odour.

17. The scales of steel are harder and sharper than those of iron, and consequently more fit for polishing with.

18. In a white heat, when exposed to the blast of the bellows among the coals, it begins to sweat, weld or melt, partly with light-coloured and bright, and partly with red sparkles, but less crackling than those of iron; in a melting heat too it consumes faster.

19. By much welding, annealing, and hammering, in a slow but strong heat, steel is converted into iron;—cement steel sooner, and cast steel later.

20. Covered with powdered charcoal pressed down close upon it, and exposed to a strong heat, it acquires a slight coat, resembling black lead. By being frequently burned, it becomes as brittle as crude iron.

21. Digested with water in close vessels, it appears to yield a smaller quantity of inflammable air, or hydrogen gas, than iron.

22. Dissolved in sulphuric acid, it yields less inflammable air than soft iron does.

23. In the sulphuric, nitric, and other acids, steel, it is true, is violently attacked, but is longer in dissolving than iron; after maceration, accordingly as it is softer or harder, it appears of a lighter or darker gray colour, while iron, on the other hand, is white.

24. In the solution of steel in acids, a smaller degree of heat is produced than with tough, and still weaker than with cold-short iron.

25. It requires more nitric acid for its complete solution.

26. In the cold it is proportionably harder, and more brittle, or less malleable than pure iron.

27. In detonating with saltpetre, it yields more fixed air, or carbonic acid gas than malleable iron does.

Steel differs from crude iron chiefly in malleability, a quality which is entirely wanting in the latter, both cold and hot; still, however, they both agree in many particulars, as for instance:—

1. Crude iron, after being melted over again, and polished, acquires as light and white a hue as steel.

2. They both acquire a variegated vitreous coat in the fire.

3. Crude iron also becomes magnetic, though more slowly than steel.

4. After being subjected to a red heat, it becomes harder by being extinguished in water, and particularly when melted and immediately thrown into water.

5. It melts easier than steel, and much easier than forged iron.

6. When indurated, it strikes fire with flints, though the sparks produced by it are somewhat weaker than those generated by steel.

7. Crude iron appears to yield as much inflammable air, or hydrogen gas, as steel, by digestion in water.

8. It likewise deposits a black sediment, when macerated in acids.

9. It rusts in the air as slowly as steel.

10. When cast, it rings like steel.

Lond. Mec. Jour.

ON USING SOAP INSTEAD OF OIL FOR SETTING CUTLERY GOODS.

Whoever has used a hone either to set his razor or his pen knife, well knows the nuisance occasioned by the oil, which is perpetually daubing

and injuring one article or another. Mr. Reveley has however got over this nuisance, by taking advantage of an accidental circumstance that happened one day to him:—not having any oil to set his razor, it occurred to him to try the soap with which he was washing himself, which happened to be palm soap. This so completely answered his purpose, that he constantly used it afterwards instead of oil, both for razors and pen knives.—It sets them quicker, gives a good edge, and removes notches with great ease. That soap is a more cleanly article than oil is undeniable; oil being liable to drop on and soil every thing with which it comes into contact. It also contracts dust very easily, and as this will spoil the edge of the articles endeavoured to be set, the oil must be frequently changed. The use of soap is as cheap, if not cheaper, than that of oil, as a small square of palm soap, costing only three pence, will last a great length of time.

In order to use a hone with soap, first clean the hone from the oil formerly used with it, by means of a sponge, soap, and water; then wipe it dry, dip the soap in some clean, soft water, and wetting also the hone, rub the square of soap lightly over it, until the surface is thinly covered all over; then proceed to set the razor, or other article, in the usual way, keeping the soap sufficiently moist, and adding from time to time a little more soap and water, if it should be necessary. Observe that the soap is clean and free from dust before it is used; if it should not be so, it is easily washed clean. The razor, &c. should be strapped after setting, and again when it is put by; and the hone sponged when is is done with.

A saving in point of time has been observed by all who have used soap instead of oil. *ib.*

ON SILVERING AND GILDING BY POWDERED TIN.

The Moschus and Nusquashes of India use an application in ornamenting their work that stands the effect of the weather, which nearly equals gilding, and costs little more than common paint, which might be useful in this country, for the ornamenting and preserving iron work with a smooth surface, as chain bridges, &c.

In preparing the factitious gilding, a quantity of pure tin is melted and poured into a box, which, with them, is only a joint of bamboo, closed at both ends, except the peaforation at which the tin is poured in, which is instantly plugged up. The bamboo is then violently shaken, while the tin is melted, which makes the metal assume, when cold, the form of a very fine gray powder; this is then sifted, to separate any coarse particles, and is mixed with melted glue. When it is to be applied, it should be reduced, by the addition of water, to the consistence of a thin cream, and is laid on with a soft brush like ordinary paint; when dry, it appears like a coat of common gray water-colour, until it is gone over with an agate burnisher, and then forms a bright uniform surface of polished tin; a coating of white or gold coloured oil varnish is immediately laid over it, according as it may be intended to imitate silvering or gilding.

They use it for covering wood or leather, or other articles in constant wear, as it is very ornamental, and resists the effects of the weather.

The powder is the same as that sold by the druggists under the name of powdered tin; but their powder is not usually fine enough. If the glue is too strong, the burnisher has no effect; and if too weak, the tin crumbles off under the agate.

ib.

MANUFACTURE OF VERDIGRIS.

Mr. Hanger has introduced a great improvement in the manufacture of verdigris. He puts copper, in a very minute state of division, into a revolving vessel, or fixed vessel, in which agitators may be placed; he then pours pyrolignous acid, or acetic acid on the copper, so as to cover it only partially, and the whole is put into a state of agitation, so as to rub off the oxidated parts of the metal, and present fresh surfaces of it to the action of the acid.

When the vessel is closed, he introduces carbonic acid gas during the operation of the machine, and continues the operation until the verdigris is formed. *ib.*

ON THE FLEXIBILITY AND STRENGTH OF PORTLAND STONE.

There is some difference in the Porland stone used in London, the best and strongest being of a browner colour than the inferior. Mr. Tredgold examined the brown kind; the piece being of a regular grain, and without any seeming defect, its specific gravity was 2 113, and it absorbed one-sixteenth of its weight of water.

A piece of 2 inches in breadth, and 1.45 inches in depth, placed upon supports twenty-four inches apart, was depressed,

	lbs.	inch.
By	10	0.01
	20	0 015
	30	0.02
	40	0.022
	50	0.025
	60	0.0275
	70	0.03
	80	0.032
	90	0.035
	100	0.037

and then broke.

Of late, stone stairs, balconies, landing places are executed with a less and less quantity of stone; and there seems no prospect of any stop being put to this misplaced economy, until some dreadful accident shall happen by the fall of a crowded balcony.

These parts of buildings should certainly be made sufficiently strong to bear the greatest possible load with safety. *ib.*

ORIGIN OF MACHINE PRINTING.

The cylindrical mode of printing, in order to distinguish it from the old process, is called machine printing. It was first invented by Mr. Nicholson, so well known in the scientific and literary world. He took out a patent for it in 1799, but never appears to have carried it into practice.

Mr. Konig, a Saxon printer, seems next to have conceived it possible to print by a steam engine; but at first he expected only to increase the speed of the common press. After having attempted in vain to interest the continental printers, and get them to put his schemes into execution, he came to England about 1804, and was for some time equally unsuccessful in his application to several of the London printers; but being at length introduced to the elder Mr. Bensley, they made an arrangement together. After a short course of experiments on the making of a press having accelerated motion, and at the same time rendering the work of the man who inks the types unnecessary, Mr Konig and Mr. Bensley senior were joined by Mr. G. Woodfall and Mr. R. Taylor; but Mr. Woodfall soon retired from the partnership.—The remaining three individuals persevered in their design, in spite of the tediousness and expense unavoidable in the progress of any improvement in machinery, and which were the greater in this case from the parties being deficient in the practical knowledge of mechanics.

It was at length found that the intended improvements could not be brought to bear in the common press, and that a radical change in the mode of printing must be adopted.—Printing with cylinders was then thought of, and after two or three years spent in experiments, a small press was made, in which, instead of the printing being produced by the impression of a flat form on the paper, the sheet of paper was passed between a large roller and the usual flat form; and the types were inked, not by round dabbing balls, but by means of skins stretched over smaller rollers, under which the form of types passed in its way to the roller. Such a promise of success attended this mode of printing that it was deemed practicable to construct a larger press on the same principle. The press being exhibited to Mr Walters, the proprietor of "The Times" newspaper, two similar presses, with such improvements as the deficiencies of the old one suggested, were constructed, and "The Times" of Monday, the 28th of Nov. 1814, was the first publication printed in this manner, the rollers and forms being moved by a steam engine.

A machine was then made for Messrs. Bensley, in which the sheet of paper was placed in the feeder, and delivered from the machine printed on both sides, notwithstanding the many difficulties that always exist in keeping register; or, in other words, in causing the pages on one side to fall precisely on the back of those on the other side. There were also other improvements, and in particular, the first attempt to change the strained skins used for inking the types into rollers covered with the potter's bat, a composition of glue and treacle.

Several individuals attempted the construction of other printing presses, but generally failed in their projected improvements.

It will be seen by this sketch of the history of machine printing, that it is but incomplete; and we shall be happy to receive farther information on a subject so interesting to mankind as printing. *ib.*

METHODS OF PRODUCING A FIRE.

There are various methods of producing fire. In Caroline Islands, a piece of wood being held fast on the ground, another short piece, about a foot and a half long, of the thickness of a thumb, even, as if turned, and with the end bluntly rounded off, is held perpendicularly over it, and put in motion between the palms of the hand, like the mill used in making chocolate. The motion is at first slow, but is accumulated, and the pressure increased, when the dust produced by the friction collects round the bores, and begins to be ignited. This dust is the tinder which takes fire. The women of Eap are said to be uncommonly clever at this process.

In Radack and the Sandwich Islands they hold on the under piece of wood another piece a span long, with a blunt point, at an angle of about thirty degrees, the point of the angle being turned from the persons employed. They hold the piece of wood with both hands, the thumbs below, the fingers above, so that it may press firmly and equally, and thus move it backwards and forwards in a straight line, about two or three inches long. When the dust that collects in the groove produced by the point of the stick, begins to be heated, the pressure and the rapidity of the motion are increased.

It is to be observed, that in both methods two pieces of the same kind of wood are used, for which purpose some of equally fine grains, not too hard and not too soft, are the best. Both methods require practice, dexterity, and patience. The process of the Aleutians is the first of these methods, improved by mechanism. They manage the upright stick in the same manner as the gimblet or borer which they employ in their work. They hold and draw the string, which is twice wound round it, with both hands, the upper end turning in a piece of wood, which they hold with their mouth. In this way I have seen a piece of fir turned on another piece of fir, produce fire in a few seconds; whereas in general a much longer time is required.

The Aleutians also make fire by taking two stones with sulphur rubbed on them, which they strike together over dry moss, strewed with sulphur. *ib.*

IMPROVED MODE OF SEPARATING GOLD FROM SILVER.

Many metallurgists have conceived that the grain gold of the refiners contains a little silver; and on examination it has been found, that when this gold is dissolved in nitro-muriatic acid, there falls at the end of a few hours, a small quantity of muriate of silver. We may also well suppose that refined silver, which has been used for parting, retains a small portion of gold.

Mr. Dize, on these considerations, has endeavoured to discover some process that should separate these two metals in a more complete manner: and, after numerous experiments, he found that oil of vitriol might be very advantageously employed for that purpose; because, by its means a much smaller quantity of gold might be discovered in silver, than by the ordinary method of quartation and parting by aquafortis. The method thus pointed out by Mr. Dize, is that now in use among the refiners at Paris.

As fast as any new parcels of silver are brought to these refiners, they proceed to separate the small quantity of gold, which would otherwise be neglected, and which they estimate upon an average to be one-tenth per cent. of the weight of the silver. Now, if the many thousand ounces of silver which are annually melted are calcu-

lated, it will easily be seen how much gold is thus procured, which would otherwise be left in the silver, and lost to the world and its owner.

Mr. Dize's process consists of five distinct operations:—

1. Upon a number of stove holes, of a foot in diameter, there are placed platinum eggs, each of which contain 6lbs. of granulated silver, and 12lbs. of oil of vitriol. Each of these eggs is covered with a high cap of the same metal, with a small opening, a quarter of an inch over, at top, to let out the vapours. These stoves are arranged under a hood, which opens into the chimney of a furnace, in which a fire is kept, for the purpose of producing a strong draught of air from the hood into the flue, to carry off the vapours.

As the sulphuric acid does not act upon silver, unless heat is applied, a fire is lighted in each of the stoves; at first the solution goes on very fast, and much sulphurous acid gas is disengaged; but after two or three hours the solution goes on slower, and it requires fifteen hours in general to complete the solution.

The vapours exhaled in this dissolution of the silver is not only sulphurous acid gas, but also those of sulphuric acid itself; and, in order to prevent them from having a hurtful effect on the health of the operators, it is advisable to fit a pipe of platinum or glass to the hole in the cover of the eggs. It has been proposed, indeed, that the eggs should be covered with heads connected with receivers, in which the sulphuric acid might be condensed.

2. The silver being dissolved, the solution is poured out of the platinum eggs into stoneware pans, and water is added, so as to reduce its density to 15 or 20 deg. of Baume's hydrometer: or so that a bottle holding a pound avoirdupois of water, shall hold about 18oz. or 18oz. and a half of the solution. The solution is then left for some time to settle, and being carefully poured off the brown powder, which is in fact the gold contained in the silver, slips of copper are added, and the silver, which is separated by the copper, is carefully washed.

3. The silver obtained is melted in a crucible, and run into ingots.

4. the brown gold powder is mixed with a little saltpetre, and melted—the use of the saltpetre is to separate any portion of copper that may be contained in it.

5. The blue solution that is left after the precipitation of the silver, being a sulphate of copper, may be evaporated and crystallized, the fine large crystals picked out for sale, and the small dissolved again in water, and crystallized; or it may be employed in the preparation of various colours.

This is the process actually used at present by the French refiners instead of the usual mode by aquafortis; it remains to be ascertained with what advantages, and whether it is worth while to incur the charges. One would suppose so, by the very moderate price that they charge for performing this operation; nevertheless, there certainly exists, in these operations, certain sources of loss, which may occasion a considerable loss to the refiner. It frequently happens, that when a certain weight of silver is melted, the crucible breaks; and however carefully the ashes are examined, a small loss is sustained; and every new crucible imbibes a certain proportion of silver.

It is true, that all these broken or used pots, the ashes, and other articles, are kept in reserve, and treated as though they were an ore of silver; yet this requires charges, and after all, the original quantity of silver is never obtained. There is, therefore, some reason to apprehend that the small charge made for this sort of refining, arises more from competition than from any real advantage that the refiners make by it. *ib.*

THE MAKING OF COMMON FRENCH PLAYING CARDS.

The mode of manfacturing these common articles presents several curious circumstances: the whole process is included in five points.

1. The paper of which cards are made.
2. The mode of forming the cards themselves.
3. The printing and illumination of the figures.
4. The mode of smoothing the cards.
5. The manner of cutting them.

The paper is of three kinds:—a brown hand, which forms the centre of the card. This paper is thin, and two sheets are usually glued together to form the basis of the card. The opaqueness it imparts, and the facility with which it takes paste, are the reasons for using this paper; it is co-

vered on one side with cardmakers' paper, and on the other by pot paper.

The cardmakers' paper, which is used for the back, must be very white; without the slightest speck, lest the card should be known by its back; for the same reason it must have no frame mark, nor the maker's name.

The pot paper is used for the printed face; it must be very white, and be slightly pasted to the belly paper, as it is termed. This paper is furnished by a government board; the sheets are fourteen inches Fr. long, and eleven and a half wide, and form twenty cards of the common size. The frame mark is twenty fleurs de lys, so placed that one of them will appear in the centre of each card when cut.

None of these papers must be folded, for it would be impossible to get rid of the mark made by the fold.

The pasting these papers into cards requires considerable address. The sheets of these papers are first placed in three separate piles before the cardmakers; and after the first of white, two sheets off each pile are taken in succession and placed in a pile on his left hand, the pile being finished by a single sheet of the same as that at bottom; by which means a pile is formed in which the papers required for each card is found in its proper place, but so that the cards are alternately lying on their back and their face. After this the pasting is begun, and is rendered easy to the cardmaker by the single observation that the white paper is not to be spread with the paste unless a sheet of brown is to follow.

When the pasting is finished, the heap is covered with a sheet of paper, and placed under a press, which at first is but slightly screwed; but the pressure is increased every quarter of an hour, until the screw refuses to go any farther. The heap being then taken from the press, the edges are washed with a very soft brush dipped in water, to dissolve the paste that may have been squeezed out by the action of the press. The cards are then pasted together in pairs by the edges, with their backs turned to each other, for fear they should get spotted in printing or colouring.

The printing of French playing cards is usually from wooden blocks; they belong, indeed, to the cardmakers, but they are deposited in the government office, and the printing is performed there, on the government pot paper. The figured cards are always printed from two blocks; one containing two sets of the four kings and four queens, along with two knaves of clubs, and as many of spades. The second block prints ten knaves of hearts, and as many of diamons This arrangement arises from the circumstance that the figures on the first of these blocks are coloured with five colours, red, yellow, blue, gray, and black; while the figures of the second block have no black in them; and this difference would embarrass the colourer if it were not guarded against in this manner. Of course, they print five impressions of the king block to each single one of the red knave block; and this gives the court cards for ten packs. The plain cards have a block for each suit, each containing the cards for two packs.

The yellow colour used is made from Turkey berries, with about an eighth of alum. The red, of vermilion ground with gum water. The black is made of lamp black, mixed with glue, and left for five of six months before it is used, and frequently stirred. The blue, of indigo mixed with size. The gray is merely a dilute blue.

The colours are applied by means of stensils, made of paper, painted on both sides with several coats of oil paints. The king block requires five stensils, that being the number of its colours; the red knave block four, for the same reason. The blocks for the plain cards, as each suit is printed separately, require of course but one stensil each.

The stensils for the figured cards are made by cutting out, with a sharp pointed knife, the spaces in which

each separate colour is to be laid on; but those for the plain cards are cut out with a punch.

The stensil for any colour being placed on the sheet of cards, so as to answer correctly to the print, a quantity of colour is taken up with a soft brush, and spread thin on a board; another brush, with short, close, and hard bristles, is first rubbed on the newly coloured board, and then on the stensil; the brush drives the colour through the holes cut in it, and thus illumines the card. The stensil being taken off, the sheet of cards is placed in a pile on one side of the illuminer; and when a pile is thus illumined on one face with the colour then in use, it is illumined on the other face, so that the sheet of cards first coloured on one side, becomes the last that is coloured on the other. The other colours are then laid on with their respective stensils.

When the sheets of cards are illumined, or dressed, as it is termed, they are separated, and each sheet is heated by itself on a square stove with a flat top; one sheet being placed on each side, and one on the top; they heat very quickly, and are turned, yet so that the back of the card may be heated the most.

As soon as the colours are perfectly dry, and the sheet of cards of a proper heat, they are soaped, which is performed with a rubber made of old hats sewed together. This rubber is about three inches thick, and the same size as the sheet of cards; this rubber is passed over a cake of dry soap, and then over the warm sheet, first on the painted side, and then on the back.

After this the sheets of cards are polished, while hot, with a stone; the back is polished with more force, and with a more convex stone rubber than the painted side. The card sheets are then put again under the press for some time, to make them perfectly flat.

The sheets being now finished, there remains only the cutting of them into single cards. This is done on a flat strong plank, placed upright on its side, and having a raised border on the two ends. Parallel to one of these sides, at the exact distance of the length of a card, a knife edge is screwed down; and by means of a screw another knife edge is capable of being brought down in contact with it. At the other end of the table a similar knife edge is placed, parallel to the raised edge and at the exact distance of the breadth of a card.

The workman then taking a sheet of cards, with the illumined side uppermost, first cuts off the rough edge by causing the knife edge to follow the printed border; he then pushes the sheet home to the raised border, and repeats the cut; proceeding in this manner, the sheet is cut into four strips, each of which is then divided across into five equal parts, or single cards.

The cards thus cut are then sorted and examined; the specked cards separated to be sold by the pound, and the perfect cards made up into packs.

This mode of making and colouring common cards may be used for manufacturing cheap illumined cards, for certain branches of education. *ib.*

ENTOMOLOGY.

What will be the best method to preserve a collection of dead insects from the depredations of live ones?

INSECTUM.

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